



Amblyopia Among Children with Refractive Errors Attending at Outpatient Department of a Tertiary Care Hospital

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Abstract: *Background:* Childhood blindness, though affecting a small proportion of the global blind population, accounts for a high number of blind years due to early onset. Refractive errors and amblyopia are among the most common causes of visual impairment in children. In Bangladesh, the rate of spectacle use remains low despite the high prevalence of correctable refractive errors. *Objective:* To determine the rate of amblyopia among children with refractive errors attending a tertiary care hospital. *Methods:* This descriptive cross-sectional study was conducted at the Department of Ophthalmology, Sylhet MAG Osmani Medical College Hospital, from January to December 2019. It involved 100 children aged 5–15 years with best-corrected visual acuity below 20/40 and no organic lesions. Data were collected through interviews and ophthalmic examinations including visual acuity testing, cycloplegic refraction, and ocular alignment assessments. *Results:* The mean age was 12.47±2.44 years; 55% were female and 45% male. Among them, 20% were aged ≤10 years, and 80% >10 years. Bilateral astigmatism was the most common refractive error (40%), followed by bilateral myopia (33%) and bilateral hypermetropia (4%). Unilateral refractive errors included myopia, hypermetropia, and astigmatism in both right and left eyes. Amblyopia was observed in approximately 40% of the children, with ametropic amblyopia being most prevalent. Anisometropic and hypermetropic children had a higher amblyopia rate, while none was found in simple myopia cases. *Conclusion:* A significant proportion of children with refractive errors had amblyopia. Wider population-based studies are recommended to better estimate true prevalence and support early detection.

Keywords: Amblyopia, Refractive Error, Childhood Blindness, Visual Impairment, Ocular Morbidity.

Article at a glance:

Study Purpose: The study investigates the rate of amblyopia among children with refractive errors attending a tertiary care hospital in Bangladesh.

Key findings: Amblyopia was observed in 40% of children with refractive errors, with ametropic amblyopia being the most prevalent.

Newer findings: Children with anisometropia and hypermetropia had a higher rate of amblyopia, while simple myopia showed no cases of amblyopia.

Abbreviations: BCVA - Best Corrected Visual Acuity, AST - Astigmatism, MYO - Myopia



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Original Research Article

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INTRODUCTION

Many of the causes of childhood blindness are avoidable, being either preventable or treatable. Only three per cent of the world's blind population are children. However, because children have a lifetime of blindness ahead of them, the number of 'blind person years' resulting from blindness

starting in childhood is second only to cataract.¹ Refractive errors and amblyopia are one of the most common causes of visual loss in children.² Refractive error occurs when there is failure of the eye to correctly focus rays of light from an object onto the retinal plane. The resultant image

perceived by the individual is blurred and refractive correction is required in order to see clearly. Refractive error can be divided into myopia ('short or near-sightedness'), hyperopia ('long or far-sightedness') and astigmatism.³ According to Bangladesh National Blindness and Low Vision Survey (2002) there are about 3.3 million cases of refractive error in adults and 1.3 million cases among children (i.e. 3.5 % of the whole population). Despite the huge numbers of people are in need of refractive error correction, only 3% of them use spectacles and the rest remain uncorrected.⁴ Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children developing amblyopia and in adults such as, lost educational and employment opportunities, lost economic gain for individuals, families and societies; and impaired quality of life.⁵

Amblyopia, often called 'lazy eye' is a decrease in visual acuity resulting from abnormal visual development in infancy and early childhood. The vision loss ranges from mild (worse than 20/25) to severe (legal blindness, 20/200 or worse). Although generally unilateral, amblyopia may affect both eyes.⁶ Amblyopia is accompanied by one or more known amblyogenic factors, such as strabismus, anisometropia, high refractive error, and cataract. Amblyogenic factors interfere with normal development of the visual pathways during a critical period of maturation. The result is structural and functional impairment of the visual cortex, and impaired form vision.⁷ With 625 million children under the age of 5 years worldwide, more than 15 million may have amblyopia, and more than half of them will not be identified before they reach school age. The consequences of not identifying and treating amblyopia early include permanent visual impairment, adverse effects on school performance, poor fine motor skills, social interactions, and self-image.^{7, 8} Moreover, permanent monocular visual impairment due to amblyopia is a risk factor for total blindness if the better eye is injured or if the fellow eye is affected by disease later in life.⁹ In a cross-sectional study, 6500 school going children in Kishoreganj district, Bangladesh were screened for refractive errors. Refractive error was found in 15% of student, out of which 7.9% were girls and 7.1% were boys. Myopia was the most common refractive error (8%) followed by astigmatism (4%) and hypermetropia

(3%). Amblyopia was found in 30 (0.46%) children⁴. But the study was old to date and was conducted about twenty years ago. Moreover, a study done on visual impairment in school children in southern India reported rate of myopia to be 8.6%; hypermetropia 22.6%; astigmatism 10.3% and amblyopia 1.1%.¹⁰ Refractive error is a very important cause of visual blindness and amblyopia. The ocular morbidity if detected and treated early in life can prevent the social and intellectual underdevelopment of the child. Despite the recognized importance of correcting ocular morbidity in children, population-based data on this issue is limited in our country. This study was aimed at detecting amblyopia among children with refractive errors.

OBJECTIVE

General Objectives

To observe the rate of amblyopia among the children with refractive errors attending at a tertiary care hospital.

Specific Objectives

To record the frequency of different refractive errors among the children attending at outpatient department of a tertiary care hospital.

To record the frequency of amblyopia among the attending children.

To record the types of amblyopia among the attending children.

METHODOLOGY

Study Design: Descriptive cross-sectional study.

Place of Study: Department of Ophthalmology, Sylhet MAG Osmani Medical College Hospital, Sylhet.

Study Period: From January 2019 to December 2019 (One year after approval of the protocol)

Study population: Children aged 5-15 years having vision < 20/40 without any organic lesion.

Sampling Method: Purposive convenient sampling.

Sample size:

Considering 4.4% rate for this study (as prevalence of amblyopia), sample size calculation was done by the following statistical formula.

$$n = \frac{Z^2 pq}{d^2}$$

For this study, I have calculated sample size with 95 % confidence interval and 5% Marginal error.

For 4.4% rate $P=.044$, $q= (1-P)$ and for 95% confidence level $Z = 1.96$ and for 5% error $(d) = .05$

$n = P(1-P)Z^2/(\text{error})^2$

$n = .044(1-.044)1.96^2/ (.05)^2$

$n = 68$

Total 100 children with refractive errors were included in this study.

Study Purpose

The purpose of this study was to observe the rate of amblyopia among children with refractive errors who attended the outpatient department of a tertiary care hospital.

Inclusion Criteria

Age 5-15 years

Best corrected visual acuity in one or both eye 20/40 or less than 20/40 in absence of any organic lesion

Exclusion Criteria

Previous history of ocular surgery

History of ocular trauma

Diseases affecting the vision

Mental retardation

Ptosis covering the pupil

Media opacity

Strabismus

Congenital ocular anomalies

Impaired fixation such as nystagmus, eccentric fixation and others

Study Procedure

The study was approved by the Ethical Review Committee of Sylhet MAG Osmani Medical College Hospital and followed the principles of the Declaration of Helsinki. Children aged 5–12 years attending the Ophthalmology Outpatient Department were screened and those with best corrected visual acuity of 20/40 or worse without organic lesions were considered for inclusion.

Exclusion criteria were applied, and informed written consent was obtained from parents or guardians. A structured questionnaire was used during face-to-face interviews to collect socio-demographic data and clinical histories. Ophthalmic examinations included Snellen visual acuity testing, cycloplegic refraction using 1% cyclopentolate, and both anterior and posterior segment evaluations. Tools like streak retinoscope, auto-refractometer, slit lamp biomicroscope, and ophthalmoscope were used for assessment. Ocular alignment and motility were documented using the cover-uncover test. Diagnoses were confirmed by the Resident Surgeon of Ophthalmology, and amblyopia was defined according to the American Academy of Ophthalmology's criteria. Based on findings, children were grouped into organic, refractive, and amblyopic subgroups using standard definitions. All collected data were compiled in case record forms and analyzed using SPSS version 22.

Data Analysis

Data were collected, checked, and entered using Microsoft Word 16 and Microsoft Excel 16, then processed and analyzed both manually and using SPSS (Statistical Package for Social Sciences) version 22.0. Quantitative data were presented as mean and standard deviation, while qualitative data were expressed as frequency and percentage. A probability (p) value of 0.05 or less was considered statistically significant throughout the study.

RESULT

The study was done in the Department of Ophthalmology, Sylhet MAG Osmani Medical College Hospital, Sylhet on 100 children who had refractive errors. Among the study population, 20% aged ≤ 10 years and 80% aged > 10 years. The mean age of the patients was 12.47 ± 2.44 years.

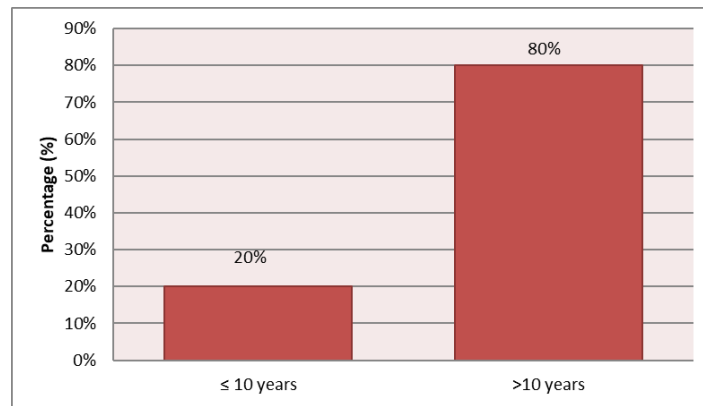


Figure 1: Distribution of Age of The Patients (n=100).

Among the study population 45% were male and 55% were female.

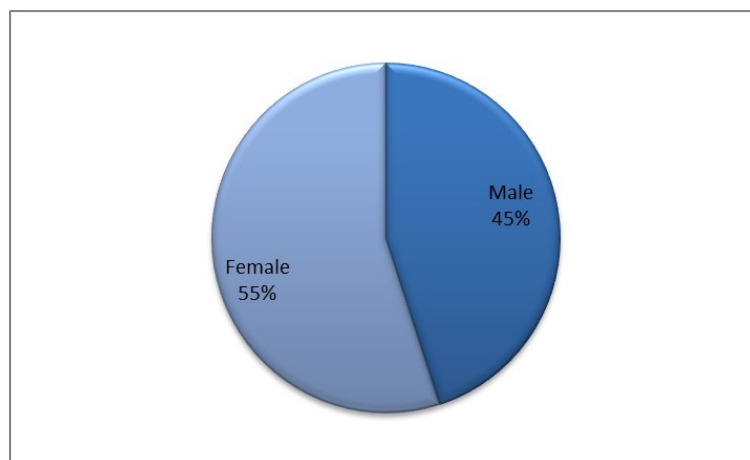


Figure 2: Distribution of Gender of The Patients (n=100).

Among the study children 10% of the children's Guardians (Father) were government employee, 15% were non-government employee, 28% were businessman, and 47% were other

professionals. Government employee, 15% were non-government employee, 28% were businessman, and 47% were other professionals.

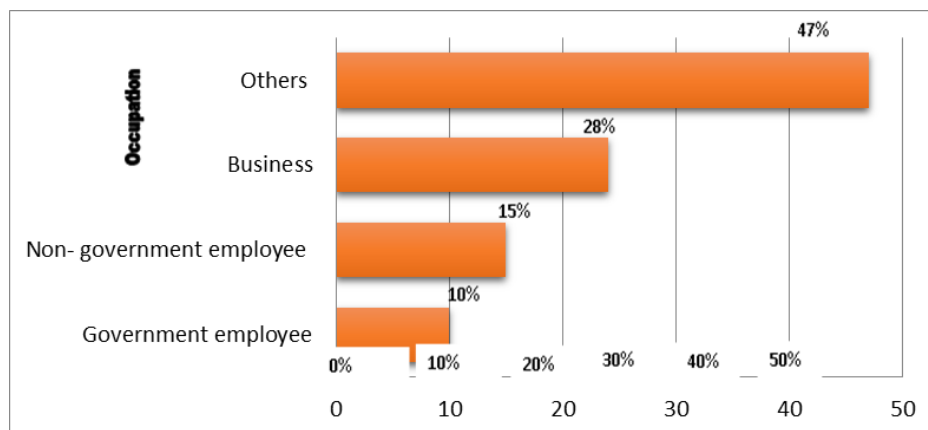


Figure 3: Occupation of The Children's Guardians (Father) (n=100).

Among the study population dimness of vision was present in 100% cases, headache was

present in 18% cases and watering was present in 04% cases.

Table 1: Clinical Features of the Subjects (n=100).

Clinical features	Number (%)
Dimness of vision	100
Headache	18
Watering	04

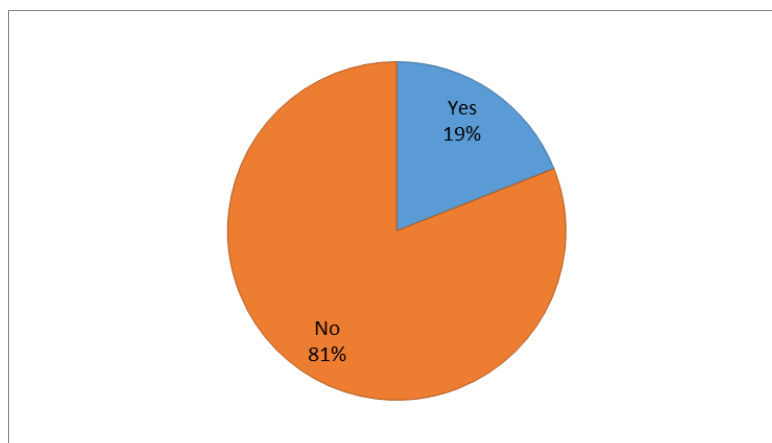
Out of 100 study population bilateral myopia was present in 33% cases, bilateral hypermetropia was present in 04% cases and bilateral astigmatism was present in 40% cases. In rest of the cases laterality was observed that is only

involvement of one eye like in right eye myopia, hypermetropia and astigmatism was present in 12, 01, and 08 patients respectively and that also in left eye myopia, hypermetropia and astigmatism was present in 06, 02 and 05 patients respectively.

Table 2: Refractive Errors of The Patients (n=100)

Refractive errors		Number (%)
Both eye	Myopia	33
	Hypermetropia	04
	Astigmatism	40
Right eye	Myopia	12
	Hypermetropia	01
	Astigmatism	08
	Emmetropia	02
Left eye	Myopia	06
	Hypermetropia	02
	Astigmatism	05
	Emmetropia	10

Among the study population anisometropia was present in 19% cases.

**Figure 4: Anisometropia Among the Study Children (n=100).**

Among the 100 children of refractive errors amblyopia was present in 39% cases.

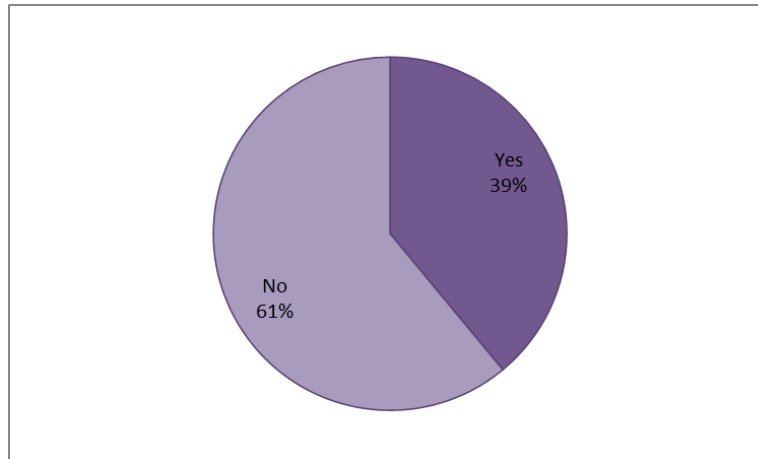


Figure 5: Frequency of Amblyopia Among Children (n=100).

Among 39 amblyopic children 04 (10%) children had severe amblyopia and 35 (90%) patients had mild to moderate amblyopia.

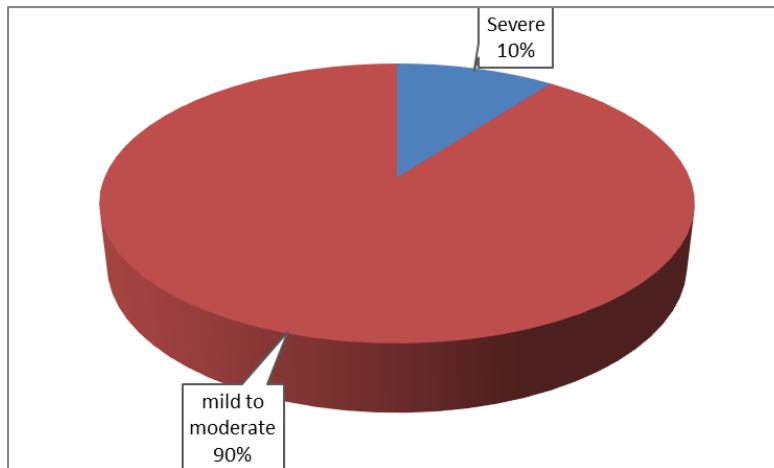


Figure-6: Severity of Amblyopia Among Amblyopic Children (n=39).

Out of 39 amblyopic children, ametropic amblyopia was present in 22 (56.41%) children, anisometric amblyopia was present in 13 (33.33%)

children, and meridional amblyopia was present in 4 (10.26%) children.

Table 3: Different Subtypes of Amblyopia (n=39).

Types of amblyopia	Number (%)
Ametropic amblyopia	56.41
Anisometric amblyopia	33.33
Meridional amblyopia	10.26

The mean age of the patient's having amblyopia was 12.13 ± 2.62 years while the mean age of non-amblyopic patients was 12.69 ± 2.32 years ($p=0.265$). Development of amblyopia was not statistically associated with age distribution, gender and residence of patients ($P=0.084$, 0.508

and 0.093 respectively). But amblyopia is significantly associated with presence of anisometric ($P=0.004$) and types of refractive errors ($P=0.002$ and <0.001 for right and left eye respectively).

Table 4: Association of Amblyopia with Different Factors (n=100).

Variable		Amblyopic group	Non-amblyopic group	P- value
Age group	≤ 10 years	11 (55)	09 (45)	0.084
	>10 years	28 (35)	52 (65)	
Gender	Male	18 (40)	27 (60)	0.508
	Female	21 (38.18)	34 (61.82)	
Residence	Urban	16 (50)	16 (50)	0.093
	Rural	23 (33.82)	45 (66.18)	
Presence of anisometria	Yes	13 (68.42)	06 (31.58)	0.004
	No	26 (32.10)	55 (67.90)	
Refractive error in right eye	Myopia	11 (31.43)	34 (68.57)	0.002
	Hypermetropia	05 (100)	00 (00)	
	Astigmatism	22 (45.83)	26 (54.17)	
Refractive error in left eye	Myopia	06 (15.38)	33 (84.62)	<0.001
	Hypermetropia	09 (90)	01 (10)	
	Astigmatism	19 (46.34)	22 (53.66)	

DISCUSSION

Visual impairment is a major global health problem and it has a serious impact on personal and social life of children. It is also one of the most common causes of handicapping in children. In 2010, the number of blind children (0-14 years) was 1.42 million, number of children (0-14 years) having low vision was 17.52 million and number of children (0-14 years) having visual impairment was 18.92 million.¹¹ Although different eye causes of blindness and vision impairment are gradually decreased but refractive errors are still in rising trends.¹² Uncorrected refractive errors have immediate and long-term effects in children by developing amblyopia, hampering education, and impairing quality of life.¹³

The mean age of the children was 12.47±2.44 years. Among 100 children of refractive errors 20% aged ≤ 10 years and 80% aged >10 years. Study conducted by Juhi-mittal and associates found mean age of their refractive error children 10.75±2.96 years and snaha-mittal and associates observed mean age of their refractive error children 10.90±3.16 years and the results of both the studies are nearly consistent to the finding of this study.¹⁴ Among the 100 children of refractive errors 55% were female child and 45% were male child. Saha and co-researchers as well as Raihan and co-researchers also found relatively higher prevalence of refractive error in female children. Raihan and co-researcher found 52.10% of their refractive errors

cases in female gender group and 47.90% of their refractive errors cases in male gender group.¹⁶ Dimness of vision is found the commonest presenting complaint followed by headache and watering. Study conducted by data and associates also found dimness of vision as the commonest presenting problem followed by headache.¹⁷ Out of 100 study children, bilateral astigmatism was found in 40% of cases, bilateral myopia in 33% and bilateral hypermetropia was found in only 04% of children. In rest of the cases laterality was observed that is only involvement of one eye like in right eye myopia, hypermetropia and astigmatism was present in 12, 01, and 08 patients respectively and that also in left eye myopia, hypermetropia and astigmatism was present in 06, 02 and 05 patients respectively. Anisometropia was found in overall 19% of children. Study conducted by Hameed and co-researchers, Sathyan and co-researchers and Fuller and co-researchers also found astigmatism as the commonest type of refractive error among their study children in their respective studies.¹⁸⁻²⁰ Another study conducted by Hazarika and co-researchers observed astigmatism among their 55% of study children, myopia among their 34% study children and hypermetropia among their 11% study children which is consistent to the findings of this study.¹⁵

Out of 100 children of this study, amblyopia was found in 39 cases. Among these 39 cases, mild to moderate amblyopia was present in

35 (90%) children and severe amblyopia was present in 04 (10%) children. Monoocular amblyopia was found in 13 (33%) children and binocular amblyopia was found in 26 (67%) children. Among the amblyopic cases, ametropic amblyopia was present in 22 (56.41%) children, anisometric amblyopia was present in 13 (33.33%) children and meridional amblyopia was present in 4 (10.26%) children. The rate of amblyopia found in this study is higher than the findings of similar other studies. No significant association was noticed between amblyopia and age, gender and residence of the patients ($P=0.084$, 0.508 and 0.093 respectively). Statistically significant higher rate of amblyopia was found among anisometric children, and hypermetropic children ($p<0.05$). In anisometric group, 68.42% children developed amblyopia while in non-anisometric group, only 31.58% developed amblyopia. Amblyopia was the lowest among myopic children and highest among hypermetropic children. Children with astigmatism had higher rate of amblyopia than myopic children and had lower rate of amblyopia than hypermetropic children. This finding is almost similar to the finding of Mocanu and associates.²¹ They also found significant association of amblyopia with anisometropia and hypermetropia. They found highest prevalence of amblyopia among their hypermetropic patients, and low prevalence of amblyopia among astigmatism patients.²² However, the actual mechanism for this higher prevalence of amblyopia among hypermetropic Patients is still unknown.

CONCLUSION

In this hospital-based study, about Two-Fifth of total study population had amblyopia and commonest subtype of amblyopia was ametropic amblyopia. The presence of amblyopia was significantly higher among anisometric and hypermetropic children. Amblyopia was not found in simple myopic children. As the study was conducted clinically in hospital among the population who had already eye problem that is refractive error. So, the rate of amblyopia was found very high where as in others cross-sectional studies the prevalence of amblyopia is low because both diseased and normal population exist. Further larger study including all settings of health care facilities should be initiated to find out exact

prevalence and to indentify the children who are at risk for developing amblyopia at a younger age.

REFERENCE

1. Gogate P, Gilbert C. Blindness in children: A worldwide perspective. *Community Eye Heal J.* 2007;20(62):32–3.
2. Jamali P, Fotouhi A, Hashemi H, Younesian M, Jafar A. Refractive Errors and Amblyopia in Children. 2009;86(4):364–9.
3. Williams KM, Verhoeven VJM, Cumberland P, Bertelsen G, Wolfram C, Buitendijk GHS, et al. Prevalence of refractive error in Europe: the European Eye Epidemiology (E3) Consortium. *Eur J Epidemiol.* 2015;30(4):305–15.
4. Quadir M, Munjifa R, Akhter S. A Study of Refractive Status of School Going Children Aged Between 10 to 15 Years in Kishoreganj District of Bangladesh. *SSNI Med Col J.* 2016;1(2):88–92.
5. Gomez-Salazar F, Campos-Romero A, Gomez-Campaña H, Cruz-Zamudio C, Chaidez-Felix M, Leon-Sicairos N, et al. Refractive errors among children, adolescents and adults attending eye clinics in Mexico. *Int J Ophthalmol.* 2017;10(5):796–802.
6. Doshi NR, Rodriguez MLF. Amblyopia. *Am Fam Physician.* 2007;75(3):361-7.
7. Birch EE. Amblyopia and binocular vision. *Prog Retin Eye Res.* 2013;33(1):67–84.
8. Wu C, Hunter DG. Amblyopia: Diagnostic and therapeutic options. *Am J Ophthalmol.* 2006;141(1).
9. Rahi JS, Logan S, Timms C, Russell-Eggitt I, Taylor D. Risk, causes, and outcomes of visual impairment after loss of vision in the non-amblyopic eye: A population-based study. *Lancet.* 2002;360(9333):597–602.
10. Kalikivayi V, Naduvilath TJ, Bansal AK, Dandona L. Visual impairment in school children in southern India. *Indian J Ophthalmol.* 1997;45(2):129–34.
11. WHO. Global Data on. *Glob Data Vis Impair* 2010. 2010;17.

- <http://www.who.int/blindness/Globaldatafinalforweb.pdf>
12. Clare Gilbert, Richard Bowman A, Malik N. The epidemiology of blindness in children: changing priorities. *Hell Holy L.* 2011;158-75.
 13. Honavar S. The burden of uncorrected refractive error. *Indian J Ophthalmol.* 2019;67(5):577.
 14. Mittal S, Maitreya A, Dhasmana R. Clinical profile of refractive errors in children in a tertiary care hospital of Northern India. *Int J Community Med Public Heal.* 2016;3(5):1189-94.
 15. Saha M, Ranjan A, Islam MN, Mukherji S. Prevalence of Refractive Errors among the School going Children at a Tertiary Center of West Bengal. *Int J Sci Study.* 2017;5(4):179-82.
 16. John DD, Paul P, Kujur ES, David S, Jasper S, Muliyl J. Prevalence of refractive errors and number needed to screen among rural high school children in Southern India: A cross-sectional study. *J Clin Diagnostic Res.* 2017;11(8):16-9.
 17. Das A, Dutta H, Bhaduri G, De Ajay S, Sarkar K, Bannerjee M. A study on refractive errors among school children in Kolkata. *J Indian Med Assoc.* 2007;105(4):169-72.
 18. Sathyan S. Vision screening at schools. *Kerala J Ophthalmol.* 2017;29:160-7.
 19. Alrahili NHR, Jadidy ES, Alahmadi BSH, Abdula'al MF, Jadidy AS, Alhusaini AA. Prevalence of uncorrected refractive errors among children aged 3-10 years in western Saudi Arabia. *Saudi Med J.* 2017;38(8):804-10.
 20. Fuller JR, Baxter LA, Harun S, Levy IS. Astigmatism in Bangladeshi and white school entrants in East London: A prospective comparative study. *Eye.* 1995;9(6):794-6.
 21. Rajavi Z, Sabbaghi H, Baghini A, Yaseri M, Moein H, Akbarian S. Prevalence of amblyopia and refractive errors among primary school children. *J Ophthalmic Vis Res.* 2015;10(4):408-16.
 22. Mocanu V, Horhat R. Prevalence and risk factors of amblyopia among refractive errors in an Eastern European population. *Med.* 2018;54(1):1-11.

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